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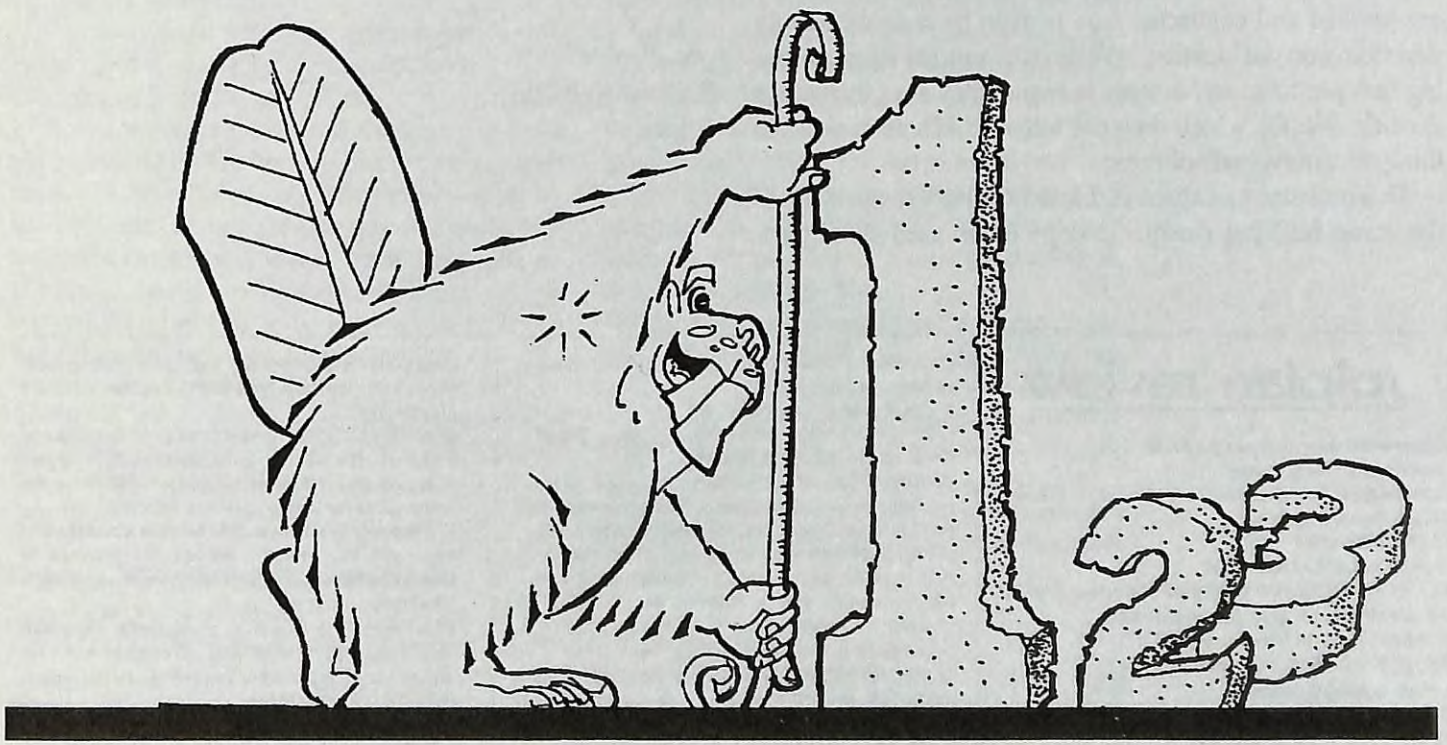


From the Editor . . .

Have we lost our sense of place? As homebuilders, we live with and create the myth that we are creating communities. However, we are increasingly living in a world influenced by cyberspace. Much of what we deal with in the business world is completely ethereal - in the electronic world, there is little need for a physical presence. As I travel around and look at the built environment throughout North America, and increasingly in other parts of the world, I begin to wonder.

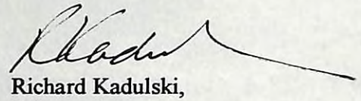
I recently read a newspaper article about an architectural firm that has found a way of creating work spaces that have no grounding in the place where they are being built. This firm has also purposely designed homes with no sense of place.

That kind of design philosophy may be a fine, abstract idea. However, we are still physical creatures. We occupy space. We want to touch others; we want to smell the flowers; we want to taste the food we eat. We need a place to call home, and it will be a physical space here on earth. With it comes a specific location, which has its unique properties, views, weather challenges, etc.

As designers and builders, we cannot forget that there are challenges specific to every location. Although increasingly we are using standardized products and systems, the way they are applied and connected may need to be done differently depending on the location. We must be critical when assessing new products and designs to ensure they are suited to the specific site for which they are intended. There is no such thing as a universal solution.

This may seem an abstract discussion, but I see so many of the same building designs and products used throughout North America (and increasingly in other parts of the world), regardless of the location. Yet we know that the climate in Vancouver, Winnipeg or Toronto is significantly different in each place, and more so than in Southern California or Florida. Just because we may have the technology to make a glass box habitable anywhere does not mean that all buildings should be built of glass. Such an approach is energy intensive and environmentally irresponsible.

We need to reconsider those traditional designs; what was it in their design and construction that made them work? Buildings looked different because each had elements that responded well to the specific climatic conditions of the region they were built in. What is also interesting, they did not have as many problems as we see today because the technology may have been better suited to the location. It may seem common sense to consider climate adapted building design, but in the electronic cyber world such an idea may be innovative. Let's not forget that, in the building industry, we are dealing with real world physical constructions.



Richard Kadulski,
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Fun With Numbers

International comparisons of house energy performance are difficult because of inconsistent definition of terms. Energy use for space heating in new energy efficient homes in cold climates is a small portion of total household energy used. Waste heat from appliances now provides a major portion of space heating.

The main difference between new houses in cold and warm climates are the technologies used to achieve thermal comfort. Total energy use is now the most appropriate indicator of performance.

We give kids "fun with numbers" arithmetic books so when they grow up they will not be afraid of math. The real keeners grow up to become statisticians!

This comes to mind when looking at the findings of a recent International Energy Agency report that tried to compare the energy performance of houses in seven countries. International comparisons are complicated by inconsistent definitions of key terms. The study looked at available data on houses in seven countries and twenty different indicators of energy efficiency. It found that the results depend on what is being compared and how.

Uniform measurement becomes important as we try to credit reductions in greenhouse gas emissions. Emissions credit trading may take place because sometimes it may be more cost effective in the short term to pay for energy efficiency improvements somewhere else rather than undertake immediate and extensive upgrades. For example, a coal burning electrical plant in Alberta or Nova Scotia may find it cheaper in the short term to subsidize residential and commercial building energy efficiency improvements inside or even outside their immediate trading area, rather than change the thermal plant.

The homes in the study represented a wide range of locations, designs, and efficiencies. Their size ranged from 107 to 223 m^2.

A major problem was that there was no complete data for many homes. For example, many houses had carefully instrumented single systems, such as a solar heater system or ground source heat pump but did not have whole-house energy metering. Others monitored energy use for only a few months, while still others were unclear how energy sources were measured. Full building thermal characteristics, numbers and types of appliances in the house, indoor temperatures, or the number of occupants were not recorded. The exception was the R-2000 homes database which has all this data (and more).

Calculating Energy Efficiency

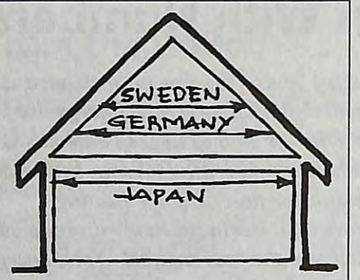
Measurement of energy efficiency may seem a simple matter of reading a meter or fuel bill or the energy used by the furnace or boiler. However, that is only one very simple indicator. Some people calculate only the energy used at the house, others consider entire energy system use, so that generation and distribution losses in the entire energy grid are also taken into account. Even how energy content of fuel is measured varies, as Europe and the United States measure the energy content of fuels differently. Houses that appear energy efficient based on how much energy is used when measured at the house are not so efficient when offsite energy use is also considered.

Until recently, the focus on residential energy consumption has been on space heating. However, in newer more energy efficient homes in cold climates the use of energy for space heating is becoming a small portion of total household energy used. Appliance waste heat may now be providing a major portion of heating requirements, so the energy consumed by traditional heating systems is often less than one third of total energy use, and can no longer be examined in isolation. That is why we have to consider the total energy use of buildings rather than just focus on space heating. For example, the sauna in the Finnish house consumed nearly 6 kWh/day, most of this eventually becoming useful internal gains.

The greatest distinction between new, cold-climate houses and warmer-climate houses is not how much space heat is consumed—it is about the same for both—but the technologies used to achieve the same level of thermal comfort. Simple indicators of energy performance cannot capture these effects. For these reasons, total energy use is increasingly the most appropriate indicator of performance.

Calculating the Liveable Floor Area

The floor area is an important, commonly used factor for comparison. Unfortunately, every coun-



Level at which attic space floor area calculation is taken in each country.

try seems to calculate the liveable portion differently. In many European houses, the living area under the roofs (or attics) represents a significant fraction of the total floor area. Because of the different methods of calculation, the same house in Japan, Germany or Sweden would have substantially different floor areas. If this inconsistency is overlooked, Swedish houses appear 25% less efficient (per unit of floor area) than their Japanese counterparts. Adjusting for this discrepancy alone makes Swedish houses much more efficient.

Other variations include calculating gross versus net floor area, treatment of basements, garages, and distinctions between heated floor area and total floor area. These definitions are typically inconsistent between countries and sometimes even inside countries because they vary with construction type.

Even within Canada, local zoning regulations use different methods of calculation. In some places any space more than four feet high is counted as floor area, while elsewhere it may be higher, or spaces such as basements may be completely excluded.

Calculating Degree-Days

The number of degree-days is a useful indicator of the severity of the winter. However, there is no single definition of a degree-day, so there is no simple way to convert degree-day information. Each country has special variants to suit its needs as shown in the Table.

Degree Day Definitions

Country	Heating begins	Inside temperature	Calculation	Time of year
Germany, Poland	T_{out} <15°C	20°C	$T_{in} - T_{out}$	Sept - May
Sweden, Finland, Norway				depends on location
fall	T_{out} <12°C	20°C	17°C - T_{out}	
spring	T_{out} <10°C	20°C	17°C - T_{out}	
Canada, United States	T_{out} <18°C	21°C	18°C - T_{out}	
Japan	T_{out} <18°C	n/a	18°C - T_{out}	depends on location

Use and Occupancy

Use and occupancy assumptions can also have a big impact on a home's energy performance. High occupancy combined with low appliance energy and low indoor temperatures will affect energy use.

The Polish house studied was small, occupied by a family of six, and consumed very little electricity for appliances. It looked like a moderately energy efficient house. In fact, the low energy use was due to the home's high occupancy. It also had fewer appliances and relied on a district heating system (the heat was generated in a neighborhood heating plant and shared by many units).

The Japanese house appeared to be very efficient. However, the four occupants maintained the house at 13 - 20°C during the winter, but most of the time above 17°C. A small portable electric heater provided personal heating for the occupants when sitting in the living room and allowed them to maintain comfort at lower room air temperatures. The heat recovery ventilator was used only during the daytime. Cold water was normally used in the washing machine.

The quality of the indoor environment, such as temperature, air quality, and other amenities, is not adequately reflected in any of the indicators. This rises in importance because some amenities are energy-intensive.

As the study showed, any modern house can be considered as the most efficient – it all depends on which criteria are being used for the comparison. As all builders who've had to compete on a bid know, you just hope that all bidders are basing their costs on the same specifications. The same goes for energy efficiency. To be an honest comparison, you have to use the same base criteria on which to make the judgement.

Indicators of Energy Efficiency in Cold-climate Buildings. *Results from an Expert Working Group for the International Energy Agency.*
Copies of the full report can be downloaded from http://eetd.lbl.gov/Buildings/ALAN/Indicators99/

Mould, moisture and mildew in attics:
Prevention and Cure Mean Healthier Homes, Energy Savings and New Business

Canam's Zerodraft residential 'comfort contracting' division has been working with local roofing, insurance and home inspection communities to fix problems with wet attics. This article covers the latest developments in a story of how roofers and other interested parties are co-operating with home performance contractors for the first time on issues of liability, technical rethinking and customer service. It also describes repairs and preventive measures that are being carried out, and how a new business opportunity is being created in cold climate areas as a result.

The world of the roofer is changing quickly. Until the last year or so, the roofer was blamed for ice-damming and wet attic problems. The solution was to add attic ventilation, in many cases more than was required by building codes. Why? Because this was the roofer's only choice. To give the homeowner a full manufacturer's warranty, ventilation had to be installed to the local building code - one square foot of ventilation for every 300 square feet of insulated attic space, and twice that amount for low-slope roofs.

Unknowingly, the roofing industry was making the wet attic situation worse. How? They were following the correct procedure for ventilation, but only solving part of the problem. Ventilating a previously unventilated attic makes the attic colder. If nothing is done to stop warm moist air entering the attic space, condensation on the now cooler surfaces is a certainty. This will lead to mould and mildew growth. Eventually water and mould spores will find their way into the living space. Insulation contractors, suffering from the same lack of information about attics as roofers, have caused similar problems. Insulating the attic floor makes the attic colder in the same way as adding ventilation. However, if the insulation contractors do not seal and insulate, they will not stop the warm moist interior air from entering the attic and causing major problems.

The problem is continent wide across a variety of climate zones. It has been identified and verified by the Institute for Home and Building Safety in Boston, an insurance-funded group that investigates, advises and explains remedial and preventive measures for any potentially catastrophic loss. According to the Insurance Bureau of Canada, of $50,000,000 worth of claims received by insurers in South west Ontario during a January 1999 storm, much of the property damage involved ice-damming and leakage. A recent roofing contractors' publication asked the question: "Who is responsible for snow or ice falling from the roof" (and injuries or killing innocent passers-by)? Until recently, insurers, like roofers, were unaware, of how insignificant ventilation was in solving the problem.

The publication last year by CMHC of Attic Venting, Moisture and Ice Dams is the strongest document yet to put attic ventilation in proper perspective. Ventilation is necessary for an attic to dry in Spring, but in too many cases ventilation cannot cope with the moisture load coming from the inside of the house. This load can be reduced by preventive measures. The number one priority in coping with attic moisture problems, including ice-damming and condensation, is to stop warm and moist air from the interior getting into the attic.

Mould and mildew spores are showing up far too often in too many homes, sometimes in houses less than two years old. Families with small children, elderly family members, or people with respiratory or allergy problems are at risk. Asthma levels in Canada have increased three-fold in the last twenty years, and have been blamed on the increase in mould. Health, comfort, structural durability, home asset value, and energy costs are all issues surrounding attic ventilation. By bringing in expert help to prevent occurrence, the roofer can provide better service, reduce callbacks and better protect the product warranty. It also means extra business for the home performance specialist, because roofers usually do not want their employees doing retrofit work in attics.

Causes and solutions

All these problems, both visible and invisible, are related. Ice-damming and attic condensation or 'wet attics', are symptoms of similar problem

By Tony Woods, President, Canam Building Envelope Specials Inc. Mississauga, Ontario
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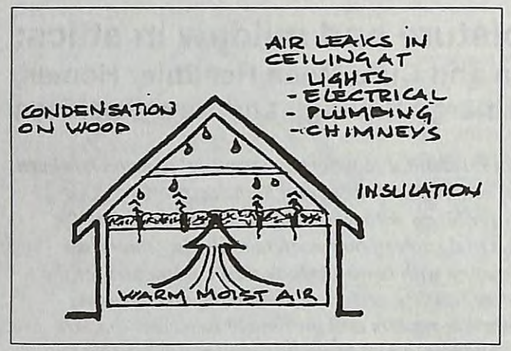


conditions in the home. They can be blamed on a whole range of 'usual suspects' - from inappropriate design, poor construction techniques and workmanship, poor communication between trades, location of heating/air-conditioning ducts, botched renovations and a high humidity lifestyle, to a combination of all these.

The solution is to isolate the attic, making it a completely separate space from the rest of the house. To do this, ensure that warmth and warm air containing moisture in the living space cannot get into the non-conditioned space in the attic. Keep the attic sealed off from the living area below (using air leakage control measures to seal holes, cracks and gaps), then add insulation as appropriate to keep the attic cold.

One-step cure and prevention

As a consulting contractor, Zerodraft tends to arrive on the scene after the 'educated' roofer has discovered the problem. If rotting, mouldy or mildewed wood has been found, clean-up and possible replacement may have to be done before the 'comfort contractor' can start work. There are times when a roof removed before replacement is very convenient for doing the work, such as situations involving a low sloped roof, cathedral ceilings, kneewalls, access problems, or aesthetic considerations. After a blower door test and/or visual inspection have been completed, the remedial work can begin. The checklist in figure 3, Where and how to seal attic leaks, shows how to make sure the usual potential leaks are covered. It is important to be on the lookout for construction that may 'bypass' the system, such as laundry chutes, retractable projection equipment, huge wall cavities, bulkheads, skylights, furnaces, and air conditioning equipment, just to name a few.

Zerodraft's trained two-person crews use a specially formulated two-component polyurethane foam attic sealing kit as its primary air sealing system. The crew wears complete safety gear whenever they work in an attic. This includes a disposable Tyvek suit with hood, gloves, safety glasses and a respirator designed to cope with organic vapours. Two cylinders of foam are placed near the centre of the attic, perhaps across two beams for extra support. With a 30-foot hose assembly, it should be possible to reach almost every corner in most attics without moving the cylinders. If the existing insulation smells badly and prevents performance of remedial measures, it may need to be removed and replaced with new insulation.

Individual crews have their own preferences about how to divide the work, depending on accessibility and type of roof. Common sense suggests that the attic be divided into manageable sections. In each section, the first crew member exposes the top plates at the perimeter and interior walls by clearing any blown insulation and lifting batt or other insulation away from the area to be sealed. The second crew member follows behind and lays one or more continuous beads of foam from the attic sealing kit to seal the leaks. When the foam cures, the second operator lays the batt insulation back on top of the seal. The crew makes ventilation improvements as they proceed. Soffit vents are added or improved, taking into account homeowner preferences for exterior aesthetics.

Knee walls require top plates and joist cavities under the half-story to be sealed with foam and the vertical wall to be insulated using mineral fibre batts. Ventilation requirements are frequently coordinated with the roofer.

As the operators move along the top plates they can deal with any electrical or plumbing penetrations they encounter along the way. For pot lights, a drywall box can be built and foamed to seal the edges.

Heating ducts in attic spaces are a major cause of roof problems and are nearly always guilty of bringing warm humid air into the attic. They are often found in houses that have been converted from electric to gas heating. The ducts are frequently damaged, have leaky joints and are poorly insulated. All ducts must be airsealed and insulated to at least R25. The Zerodraft Attic Sealing Kit can be used to totally encapsulate the ducts and seal everything to the barrier plane.

Once all cracks, gaps, holes and leaks have been satisfactorily sealed, it is time to insulate. If air sealing has been done thoroughly, use blown cellulose as the preferred insulation, because of its superior air tightening capabilities.

Before completion, the attic entry hatch must be weatherstripped using a C-fold polyethylene clad foam compression seal. Then insulate to R-30 with 3 two-inch slabs of extruded polystyrene foam cut to the exact size of the hatch. Latch with a hook and eye to hold it down firmly. Prefabricated airtight insulated metal assemblies can also be used for hatches for kneewall entryways.

The last, but very important, area is addressing the source of the moisture. This could be due to lifestyle - many teenagers taking showers, for example - or it could be a below grade problem such as a crawl space with an earthen floor. Mechanical ventilation is essential in both cases.

For a crawl space with an earthen floor or known moisture problems, put a moisture barrier consisting of a layer of 6 mil polyethylene on top of the earth and hold it in position at the perimeter walls with two-component foam. Spray the walls with two inches of foam or use extruded polystyrene foam with the joints sealed using spray foam. Sprayed foam will also effectively seal the rim joist. Also seal off any outside vents into the crawl space (effectively, making the crawl space a "shallow basement"), and ensure that some household air can circulate through the space.

Be sure to check existing exhaust fans. Most are poorly installed and often exhaust directly into the attic instead of outside. In twenty years of home contracting, we have never seen an exhaust duct sealed. These situations must be corrected as part of the remedial measures.

The new business of comfort problem solving

In the home performance contracting industry, the question of what homeowners want, what they need and what they will buy is top of mind for the business owner and the marketing people. The question of energy and environmental performance is top of mind for policy makers. Fortunately, there are participants in this fledging market who believe that both should be top of mind. These are the people who are finding ways to "kill two birds with one stone."

Zerodraft is a good example. The company has made a point of turning market reality into a business opportunity. After twenty years of pursuing energy conservation contracting at the whim of government and utility subsidies, Zerodraft has created a profitable business out of solving home performance problems. The company defines the problems it solves under the umbrella word 'comfort'. The problems cover a wide range of issues, such as health, safety, comfort, durability and energy efficiency.

Wet attics, ice-damming and other moisture related problems are creating a business opportunity for the comfort contractor. Why? Because other trades and interests are becoming aware of the risks and benefits that apply to their business: Roofers do not want to be blamed for problems they did not cause. They also see the added value of providing a service that solves a customer problem or need. Home inspectors have been caught unawares, and now realize the need to know more about potential problems. In Toronto last winter, a home inspector was sued for issuing a certificate without even going into the attic. The same goes for insurance companies, who face claims from homeowners for expensive repairs.

There is more: Energy efficiency guidelines indicate the potential energy savings from controlling air leakage. It is a side benefit, but one that appeals to policy makers, marketers and homeowners alike. Whatever you want to call your business - comfort, energy, performance, problem-solver - it is good to know there are still new opportunities for growth, profit, and job satisfaction.

Reinstallation of Gas Appliance Vents

The BC Gas Safety Branch has issued a bulletin reminding contractors carrying out building envelope repairs that all vents and vent terminations for natural gas or propane fired appliances must be removed during repairs, and must be replaced by a licensed gas fitter.

Improperly installed vent components can cause a blockage of the vent, impede the operation of the appliance, produce dangerous levels of carbon monoxide or even start fires. Natural gas or propane appliances or equipment that must be turned off, and removed must be placed in a safe location or removed from service before starting repairs. Gas supply lines must be capped off.

If vents or vent terminations are removed, covered, or located under protective coverings such as tarps, the appliances should have the natural gas or propane supply shut off and building occupants must be given written notice.

The gas fitter should attach a gas fitter's tag to each appliance that has had a vent or vent terminal reinstalled.

Wall Moisture Problems in Alberta Dwellings

We have seen much news coverage on building envelope moisture problems in the Vancouver area. As we have noted in the past, the problems are, unfortunately, not unique to Vancouver or coastal B.C. Recently, similar problems have been noted in Alberta, not only in multi-family dwellings, but also in single family homes.
The lessons to be learned from the B.C. and Alberta experience can be put to use everywhere.

Wall Moisture Problems in Alberta Dwellings by Building Envelope Engineering Inc for CMHC Research Division

Wall moisture problems are less severe in Alberta than in coastal British Columbia, but their frequency is still not acceptable. Owners do not, and should not, be expected to tolerate water entering the interiors of new or well-maintained homes. It is estimated that about 5% of new Alberta homes experience water leakage under conditions that occur on an annual or more frequent basis, and an equal proportion may experience leakage into the structure but not into the interior living space.

Although most industry participants do their best to ensure that the work over which they exert control is successfully completed, the same economic pressures that can lead to reduced quality in construction apply in Alberta. These negative pressures include pay by piecework; the lack of accountability of the persons responsible for creating the problems (who, by not being called to account, may be unaware of the problems); pressure to complete work rapidly to meet the demands of a hot market; the reliance by enforcement officials on builders and designers (and vice versa); fee shopping by developers; and faith on the part of buyers that someone else is looking after their interests so they can shop on price and appeal alone.

Substantial differences in climate lead one to expect that problems may be different in Alberta. Calgary and Edmonton's fifteen minute rainfalls are twice as much as Vancouver's, although one day rainfalls and wind loads are similar. Calgary has much greater driving-rain wind pressure than Edmonton or Vancouver. However, Alberta gets one third of the total annual precipitation of Vancouver, and peak rains occur in summer, rather than in winter. Most of Vancouver's precipitation is as rain, while a significant portion of Alberta's is snow.

In Vancouver, most rainfall occurs during winter months when the drying potential is lowest, resulting in prolonged wetting. Alberta has most of its precipitation during summer when the drying potential is greatest, and has fewer consecutive days of rain. This suggests that similar construction may be less prone to long-term damage from prolonged wetting.

A recently completed study looked at newer Alberta buildings less than 10 years old. The exterior cladding of the buildings studied included stucco, vinyl siding, metal siding and brick. The study looked at single family and low-rise residential dwellings, but was based on buildings available for review so does not provide a statistical cross-section of Alberta buildings.

Problems were most pronounced in buildings built during the past five years. This coincides with significantly increased use of window perimeter nailing flanges, vinyl (PVC) windows, housewarps, housewrap tapes, and a construction boom. More problems were reported with stucco as compared to vinyl siding. Exposure is on average more severe than in the past, because buildings are being built taller. One-storey walls were once the norm, while today the average is 2 to 3 storey walls.

Construction, workmanship and design are the most common factors contributing to problems. Most leakage could be avoided by relatively simple improvements in initial construction, but is not so simple to repair after construction is completed.

Buildings with vinyl siding seem to have fewer exterior moisture problems. On the other hand, stucco clad buildings are more likely to have significant moisture problems and the problems are, on average, more severe. It was noted that the quality of stucco rarely meets the minimum standard set by the Alberta Building Code. Stucco should be mixed using only the ingredients listed in the code. Labour saving additives that might have adverse effects on properties of the finished product, like soap, excess entrained air, and clay should not be used.

Most moisture problems occur at penetrations through the cladding such as at window and door frames, and deck and balcony connections. Minor and inexpensive improvements to the way the secondary weather barrier is connected to flashings at openings, improvements in windows and flashings, and revised deck perimeter details would eliminate most problems.

There were problems in two thirds of the walls where the exterior cladding seemed to be the most airtight element. Where the interior finish appeared to be the most airtight element, only 20% of walls had problems. This reflects better pressure-equalization between front and back of the wetted surface, resulting in lower rates of water penetration through similar defects.

Parapets rather than eaves at roof edges, soffits that slope down to a wall, exposed columns, vertical transitions, rail attachments, and scuppers are details disproportionately associated with problem walls.

Controlling Rain Penetration

Rain leakage occurs because of 3 factors: water on the wall, paths for the water to penetrate the wall surface, and forces to drive the water inward. A cavity behind the wetted surface provides a capillary break and prevents surfaces behind from getting wet. The sheathing membrane should not be sealed to allow venting.

Where the rainscreen is interrupted, install outward slope flashings at the horizontal junction between different materials and over doors and windows. Seal or baffle vertical joints. Stop cladding ½" (10 mm) or more above the horizontal surface of flashings to allow for drainage, and stop cladding 4" or more above the horizontal surfaces of roofs and decks.

Window and Door Frames

The most significant problems were noted at exposed window and door heads that were not well protected and furthest from the eave. Problems were less common on walls that were sheltered, or that faced away from the predominant winds.

Wall and window detailing generally relies on face-sealing, which often blocks potential drainage paths. It is not advantageous to seal the flange at the window head to the sheathing with caulking instead of installing a flashing because sealants may gradually work or "pump" out of the joint due to thermal movement. The top of the sealant bead will trap water if the bead is below the top edge of the flange and uneven.

Vented and drained screens, when they occur, are accidental and not deliberate. As well, flanges of vinyl windows and some aluminium windows are not stiff enough to maintain a seal between fasteners, and the compatibility of the sealant with the vinyl may also be a problem.

Window and door frames often do not have adequate projection or drips. Window manufacturers should make windows that meet effectively with properly applied sheathing membranes and cladding, without expensive alternatives like peel-and-stick membrane flashings, and without the need to augment the sills to provide effective drips. Many vinyl windows are too flexible and experience significant thermal movements that were not considered in the design.

Peel-and-stick membranes will improve the window perimeter water seal to the sheathing. However, if peel-and-stick membrane is adhered to a window sill flange and to the sheathing, it will trap water that may leak through joints in the window frame. When peel-and-stick membrane is used, it should be limited to strips of flashing around openings, adhered to the sheathing and window flanges on heads and jambs and into the sill to form a trough into the rough opening behind the nailing flange.

Below an opening, peel-and-stick should lap over the sheathing membrane (this may require leaving the release paper on the peel-and-stick membrane for the width of the lap).

For all peel-and-stick membrane installations, the substrate must be sound, compatible, primed,

Selecting Windows

- ✔ Select windows that are designed on the rainscreen principle, with provisions for drainage of the glazing rebate to the exterior.
- ✔ Select windows that project at least ½" (10 mm) beyond the face of the cladding and have an effective drip on the underside of the sill.
- ✔ Provide drips at sills of windows, with enough projection from flange to face of casing to accommodate the thickness of the cladding and still allow the drip to be effective.
- ✔ Select windows that have weep holes (10 mm minimum diameter to prevent blockage and bridging by surface tension) and a sloped drainage, allowing any water that penetrates to weep out of glazing and sash rebates.
- ✔ Select windows with continuous flange corners, sealed or fused.
- ✔ Seal joints between adjacent windows, and provide mullions designed to carry wind loads.

and laps between pieces of peel-and-stick membrane should be made to shed water.

Flashings

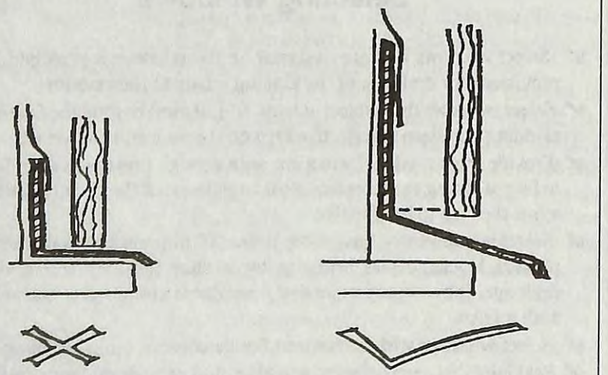
Today, flashings typically have no projection beyond the face of the frame and no drips. Use metal flashings that have a projection and effective drip edges, sloped downward and extended beyond the jambs and cladding surfaces. Sill flashings especially should have end dams. (Leave a 5 mm tab at the end of the sloped leg to be turned up to form an end dam.)

A typical off-the-shelf window head flashing has a vertical leg of 1 ½" (40 mm) compared with the 2" (50 mm) minimum required by code. The vertical legs of flashings should be a minimum of 4" (100 mm) high, especially for severe exposures. Even though the code requires only 2", the rationale behind this is not clear. Why is paper required to lap 4" (100 mm), while window flanges and flashings are not? A 140-km/h wind can result in a pressure difference of 1000 Pa between the interior and the windward exterior side of a building, equivalent to a 4" head of water. A wind of about 90 km/h is enough to lift water under the 1 ½" leg of a usual flashing.

Metal flashings as fabricated or installed often have no slope on the horizontal leg. The horizontal legs of flashings should slope a minimum of 30 degrees to ensure positive outward drainage and provide a space of at least ¼" (6 mm) between the drip edge and the vertical surface behind it. Extend flashings a minimum 1" (25 mm) beyond the jambs to the edge of the window flange or vinyl J-mould to provide an effective drip over window or door frames.

Avoid lap joints in flashings where possible. When they are required, lap them 2" (50 mm) and seal them with an appropriate sealant.

If a curved flashing is required, ensure that the vertical leg is continuous or lapped and sealed at the joints, not cut to the base to allow segments of straight flashing to be bent, or plan to counter flash it with a peel-and-stick membrane. Curved window heads should be supplied with matching stretch-formed flashings.



Typical window head flashing. Short vertical leg; horizontal leg with minimal drip edge.

Better solution: longer vertical leg, sloped horizontal leg with good drip edge overlap. Insect screen for rainscreen.

Other Details

The details used at the perimeters of decks need to be improved so they provide adequate drainage to the exterior.

Walls with drained cavities and peel-and-stick membrane flashings are potentially the least effective treatment for exposed portions of buildings on exposed sites.

The air leakage rates in most buildings are significant enough that if higher levels of indoor humidity are maintained by occupants in winter, serious moisture problems from condensation can be expected. To reduce the incidence of moisture, interior finishes should be made more airtight than the cladding, especially at windows. Air sealing at the interior plane of the gypsum board is recommended. This will reduce air leakage and neutralize the effect of wind acting on wet exterior surfaces. Current interior air barrier details, especially at window and doors need to be improved.

Install trim and accessories for vinyl and metal siding to enhance the siding's inherent rainscreeen advantages.

Sheathing papers

The most evident problem is a lack of understanding by applicators of the water shedding function of the sheathing membrane. Problems include reversed laps, even in the middle of a wall but especially at penetrations, rips and tears left unrepaired, and the use of incompatible tapes and folds which trap draining water. Prolonged exposure to weather and UV damage are other common problems

Building paper must be lapped properly with 4" (100 mm) overlaps to shed water by gravity, especially at the sills of openings and over metal flashings. A higher quality material and method of sealing are required at perimeters of window and door openings. Except around openings, standard building paper is adequate if properly installed.

It is wise to use two layers of building paper under stucco, preferably with laps and fasteners offset, especially if the paper is exposed on the site for an extended period of time.

The Alberta study also noted that tape designed for use with housewrap is used extensively with building paper to attach it to window flanges, secure butt joints, patch holes, seal reverse laps and to wrap penetrations. This probably seems reasonable to applicators since the initial tack is very good. However, the tape is often applied to wet, frosty, or dirty surfaces to which it will bond poorly. The tape has not been tested for compatibility with anything other than housewrap, and there is no assurance that the tape is suitable for joining other materials. Observations suggest it does not stick to vinyl windows or building paper.

Under most conditions, spunbonded housewraps retard vapour flow less than building paper. However, reverse vapour flow (i.e.,when vapour pressure is higher on the outside), has to be considered if housewrap is substituted for a less permeable building paper. Although water that leaks into the wall or condenses during the winter will dry out more rapidly, more condensation will occur on the exterior surface of the vapour barrier with spunbonded housewrap than with building paper when porous cladding like exterior brick or stucco is saturated with water and warmed by the sun.

Energy Globe Award 2001

The Energy Globe Award was created to honour outstanding energy efficiency and renewable energy projects and initiatives worldwide. Winners receive a prize of 10,000 euros per category. The awards will be presented during an awards gala. In addition, the best projects will also be presented during World Sustainable Energy Day and the "Energiesparmesse", one of the Europe's largest exhibitions for sustainable energy use, to be be held March 1-4, 2001 in Wels/Austria. Deadline for submission of projects is October 20, 2000. Submissions can be by mail, fax or e-mail to O.Oe. Energiesparverband.

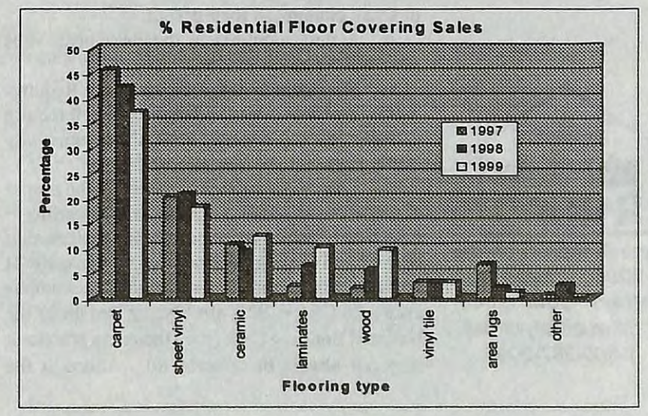
A CD-ROM with the entries and winners of the Energy Globe Award 2000 (1,000 submissions from 72 countries) is available free of charge and can be ordered by e-mail from *energy.globe@esv.or.at*

Information:
O.Oe. Energiesparverband
Landstrasse 45
A-4020 Linz Austria
Tel: +43 732 6584 4380
Fax: +43 732 6584 4383
e-mail: office@esv.or.at
Internet: www.esv.or.at

Floor Finishes

As many builders may have noted, there has been a shift in the type of floor coverings used in residential construction. Although carpets are still very popular, the proportion of hard floor materials, such as vinyl, ceramic, laminates and wood (which can contribute to better indoor air quality) has increased in recent years. ***Coverings***, a flooring industry trade publication has tracked industry sales and assembled sales data for the past few years. We've summarized their data in the accompanying table.

Information: Coverings magazine
http://floorpage.com



R-2000 Home Program
Changes in Technical Standards

The R-2000 Home Program provides the basis for the design and construction of energy efficient, environmentally friendly and healthy homes. The R-2000 program is a major reason why Canada is considered a leader in housing technology. It has had a significant impact even on standard construction in this country.

The Program's standard is not a static document, but undergoes a review every few years. The last significant review was in 1994. A new review was done over the last two years, and several revisions have been made. The revised standard will improve the energy efficiency of new housing, while minimizing incremental costs. The objectives were to ensure that the technical standard reflects current energy-efficiency trends and technologies and to provide a clearer definition of the technical requirements without increasing the cost of building an R-2000 home.

The new requirements will take effect January 1, 2001 on an optional basis, but will become mandatory as of September 1, 2000.

Today a typical R-2000 home is about 30% more energy efficient than a conventional home. Once the new changes take effect, R-2000 homes will be about 35% - 40% more energy efficient. Analysis of the cost impact of the new requirements show estimated increased construction costs of $100 - $500 for a typical R-2000 home, but can be justified by cost savings payback.

The sudden surge in energy prices underlines the difficulty of predicting the future. The costing analysis done for the new standards used conservative forecasting models. Today's higher prices result in quicker and more significant paybacks from conservation measures.

The changed energy supply situation and the ongoing concern about global climate change underline the importance of reducing energy and resource use. Improving the energy efficiency of our building stock should be a high priority. Simply put, the R-2000 standard should be considered as the minimum standard to follow in new construction to make a significant impact toward mitigating global climate change.

Key changes to the R-2000 Technical Standard:

- The text in the standard has been clarified and simplified.
- A new pre-approval method has been developed so that a house, or a group of similar houses, can be designed and pre-approved as meeting the energy target regardless of their orientation or small changes in their design.
- A new requirement that basement walls have full height insulation.
- Minimum Window Performance Requirements have been added. Effectively, it will require a double-glazed window with a low-emissivity coating, gas fill, and an insulated spacer.
- There are new requirements for the proper sizing of heating and cooling systems according to CSA F280. This has been introduced to ensure that heating and cooling systems are sized correctly. It is not a new requirement for builders since compliance with CSA F280 is already required under the National Building Code (even though in practice it may not always be adhered to). Although the required heating and cooling system capacity is calculated by HOT2000, a room-by-room calculation needs to be done according to CSA F280 by a HRAI-certified designer.
- Co-venting of natural gas, propane and oil fired space and water-heating appliances is not allowed. The intent is to ensure that all appliances used for space and water heating are not susceptible to combustion spillage as this can pose a serious health and safety risk to the occupants. Spillage-resistant appliances operate at higher efficiencies, thus saving energy and reducing operating costs.
- A new phased-in requirement will require electronically commutated furnace motors. This was introduced to reduce the high electrical energy consumption resulting from continuous operation of conventional furnace blowers used to distribute ventilation air. This will not only save electricity but will also improve comfort since ECMs are quieter to operate and can run at lower speeds without reduction in efficiency. This requirement will not be mandatory until January 1, 2002, to allow time for industry to meet the demand for approved energy-efficient motors and fan sets.

R-2000

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

A list of approved energy-efficient motors will be available from provincial R-2000 offices and the R-2000 HOME Program website at *www.oee.nrcan.gc.ca/r2000.*

- In addition to ventilation systems, heating and cooling systems will have to be inspected by a licensed R-2000 Inspector or a licensed R-2000 Mechanical Technician who will look for correct operation according to the procedures taught in the HRAI courses for the specific equipment. This new requirement is intended to ensure that mechanical systems are properly designed and verified as actually meeting their designed performance as installed. This should result in a significant improvement in occupant comfort and savings in energy.
- A reduction in the maximum water use of toilets to ultra-low flush units using 6 litres/flush (1.3 imp. gals/flush) or less.

New and update courses for R-2000 professionals and builders are being prepared and will be offered across the country starting early in the new year.

Letter to the Editor

It was a pleasant surprise to read your recent review of CMHC's ***The Household Guide to Water Efficiency*** (Solplan Review, July 2000). We talk of energy efficiency in the housing industry but rarely do we discuss the potential to reduce the excessive use of another important resource - water. The wide-spread use of the 6-litre flush toilet and low-flow shower heads has greatly reduced indoor water use but outdoor water use can result in a 50% peak of water use every summer. This peak means that our water supply plants must be oversized to meet this demand. The costs are real and borne by everyone and are really not necessary if water efficient landscaping is practiced.

I am one of the co-authors of this book that was first produced for Durham Region (Ontario) and then adapted by CMHC. I was pleased when CMHC recognized the value of this booklet for use by other municipalities.

Cate Soroczan of CMHC, who is responsible for the production of this booklet, noted that builders should call her directly (phone 613-748-2284) and not CMHC's 1-800 line to order copies as it is a special production run. Builders could have their company logo printed on the booklet if they order bulk copies. It is a very reasonably priced booklet that we agree is a good companion to the builder's homeowner manual.

As always, I enjoy Solplan Review from cover to cover each issue - keep up the good work!!

Gail Lawlor,
Energy Matters

Air Conditioner Information

Shopping for a new air conditioner? You can obtain updated information on the top-rated energy-efficient room air conditioners, central air conditioners, and heat pumps on the ACEEE Web site at *http://acee.org/consumer guide*.

The information is derived from the ACEEE's popular Consumer Guide to Home Energy Savings. Although this is a US Web site, it contains energy and money saving tips that are equally applicable to Canada, as most of the equipment is also available here.

Another useful resource is The Guide to Energy-Efficient Commercial Equipment. This publication combines information on what to consider when selecting commercial building equipment with equipment energy performance data. It focuses principally on three areas: lighting; heating, ventilating and air-conditioning (HVAC), and motors, because that is where most energy in commercial buildings is consumed. The guide also includes new information on what to look for when purchasing other energy-using equipment, including distribution transformers, office equipment, and refrigeration products.

The guide is available from the ACEE, 1001 Connecticut Ave. N.W., Suite 801 Washington, D.C. 20036
Tel.: 202-429-0063
Fax: 202-429-0193

The American Council for an Energy-Efficient Economy is a non-profit organization dedicated to advancing energy efficiency to promote both economic prosperity and environmental protection.

Technical Research Committee News

Canadian Home Builders' Association

Windows Standards: North American Harmonization Alert

With free trade and the increasing coordination of the US and Canadian economies, there is a move to harmonize technical standards in both countries.

CSA A440 is the Canadian standard for windows. An international task group with membership from both sides of the border has been working on a new standard, and a draft has already been prepared. However, for a number of reasons, most of the work to date has been done by the American side. The draft standard is closely modelled on US standards, and pressure is being put on to complete the project soon.

The proposed North American Fenestration Standard (NAFS) proposes significant differences to the current CSA air and water penetration levels, as well as the classification systems used. Some 15 significant issues have been identified. This is not an obscure issue that may be of interest only to window manufacturers. It will affect the type of products on the market, and who will manufacture them. This will have a significant impact on designers and builders.

CSA standards are developed by a process of consensus which includes all stakeholders. It is disturbing to hear that the group working on the NAFS does not include representation from all concerned. Although the large window manufacturers with active US export programs are involved and seemingly comfortable with the direction the standard is going, smaller Canadian window manufacturers not active in the export market are not represented, nor is there representation from the building industry (the users of the products), and only minimal input from regulatory agencies.

The Canadian Codes Centre and CHBA are observing the process. It would be prudent for all concerned to review the direction the harmonization is going, and to express their opinions before the final draft has been completed and implemented.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

Canadian Home Builders' Association,
Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca

Furnaces for Temporary Heat

Unless aproject can be completed over the summer, some temporary heat is usually needed during construction. Near a project's end, it is common to use the furnace to heat the house.

Builders should be aware that there are limitations on the conditions under which furnaces can be used during construction. According to CGA standards, it is not acceptable to use a furnace for temporary heat. However, there is a contradiction in the gas code, which states how to install a furnace for temporary use. The major concerns are, of course, that high levels of dust could be a hazard and extreme cold air could lead to condensation and premature failure of the equipment. The fine print on the installation instructions normally should spell out the acceptable conditions under which the furnace can be used.

This issue has been raised in Ontario, where the CGA regulations started to be applied. However, a temporary solution has been arrived at following consultations between regulators, furnace manufacturers and Ontario Home Builders, whereby manufacturers will issue instructions under what circumstances furnaces can be used for temporary heat during construction. In the future, adjustments may be made to the regulations to resolve the problem. Since the regulations apply in other jurisdictions, it would be prudent for builders to be aware of the concern, and discuss this with their mechanical contractor.

This also points out the importance of proper commissioning of mechanical systems. Before turning over the house to the new owners, the entire mechanical system should be cleaned and checked to ensure that it operates as intended. Poor commissioning of mechanical systems (heating and ventilation) is a major problem in all building types. It may come as a surprise to home builders that even in large commercial and institutional projects, which have the benefit of detailed design and oversight of construction by specialized professionals, commissioning of mechanical systems is still a major problem.

Window Design and Installation

Experience in all parts of the country points to a need to review and reconsider window system design and installation practices. Windows are the biggest source of moisture leakage from the exterior into the building. As the rainscreen is used more frequently for exterior claddings, window installation practices are being reconsidered, especially on the West and East Coasts, regions that have experienced significant moisture penetration.

The design of the window frames themselves, as well as flashings and installation procedures must undergo a review. It would be prudent for builders to approach their projects with the assumption that all windows will leak. This will mean special attention to detailing, including weather barriers, flashing, and installation techniques.

Mechanical Ventilation

Mechanical ventilation has been recognized as a necessity in our homes. The National Building Code (Mechanical Ventilation) requires compliance with CSA F326 (Residential Mechanical Ventilation). However, the standard is not "builder friendly" and requires specialized design. Many builders felt that a more prescriptive requirement was also required to reduce the need for specialized professional design for residential ventilation systems. Consequently, a prescriptive compliance path was put into the code (Section 9.32).

The prescriptive code language has been found difficult to comply with. As a result, for the past two years there have been efforts to refine the code language. Several drafts have been prepared, and tested by several contractors to see if it would be easier to use in the field. Unfortunately, it appears that it is difficult to obtain a consensus on the direction the changes should take. It may be likely that no changes will be made to the code.

It may be advisable for builders in each region to work with their mechanical contractors (through their organization) to develop a series of acceptable designs specific to types of house and heating systems used in their area. This would reflect local climate conditions, design and construction practice, and the availability of equipment and trades. This may involve professional consultants, but with a series of system designs that will work in the area which can be shown to comply with the intent of the code requirements, these could be standard templates. With standard designs, the builder, mechanical contractor, and building official could take comfort in the fact that, that if installed according to the design, the ventilation system would meet code requirements.

Owens Corning Product Changes

Manufacturers widely promote their new products. It is a different story when they stop producing something - they slink off into the night without letting anyone know.

Two Owens Corning products: Glasclad (a rigid fiberglass sheathing board insulation with a housewrap facing) and Drainclad, a rigid fiberglass board used as a foundation drainage material, are no longer available.

Licensing Requirements for Building Envelope Repairs

Effective September 30, 2000 building envelope repair contractors in BC will be required to be licensed by the Home Owner Protection Office and provide mandatory, third party warranty insurance coverage in order to get a permit applicable for building envelope repairs. This follows up on the mandatory builder licensing regulations now in place in BC.

This licensing requirement applies to work dealing with unintentional moisture ingress on walls, on buildings with more than 2 units, when the value of work is more than $2,000 per unit (or $10,000 in total). The work must also include the participation of a building envelope professional.

Information:
Home Owner Protection Office
1-800-407-7757
www.hpo.bc.ca

Energy Answers

Rob Dumont

What do you think about Canada's current residential ventilation regulations?

I am not happy with the regulations. I sat on the CSA F326 committee, and must take my share of the blame for the residential ventilation standard produced. The standard is too complicated, and requires too much exhaust air flow, which can readily backdraft chimneys in many new houses.

Designers of the ventilation standard had a noble goal of improving the air quality in houses. However, in the process the standard and the systems have gotten too complicated, and the fans are usually too powerful.

"The best is the enemy of the good." In the desire to implement the best systems, good basic systems are being overlooked. Most new houses basically have very poor ventilation. A simple, continuous ventilation system with modest air flow will greatly improve the air quality in the house.

We do have a problem with indoor air quality in new houses. Most new houses are tighter, many newer furnaces reduce the air exchange (newer furnaces do not have the naturally vented chimneys that used to serve as exhaust ventilators), and greater quantities of synthetic materials (plastics, composites, new paints, etc.) are present in our houses. With less natural air exchange and more indoor pollutant sources, air quality suffers, especially in new homes. If you don't believe me, just visit almost any new home. Anyone with a sensitive nose will not like the odours in new houses. Many allergy-prone people will get sick in poorly ventilated new houses.

What is to be done?

Here are some thoughts about what a good residential ventilation system should do. Call them Dumont's Directives for Decent Ventilation.

1. Minimize the sources of volatile organic compound (VOC) emissions. As my mother often told me:"If you don't make a mess, you won't have to clean it up." Choose interior paints, floor coverings, ceiling finishes, kitchen cabinets, vanities, etc., to minimize organic compound emissions.

2. Run the ventilation system continuously. Humans breathe continuously. The only way to ensure adequate air exchange through all weather conditions is to have the ventilation system run continuously - that is 24 hours a day, 365 days a year. Even very leaky houses will have poor ventilation during times of the year when outdoor temperatures are the same as inside, and the wind is not blowing.

3. Provide adequate, but not excessive, amounts of ventilation. I feel that the average house should have about 30 litres/second (60 cfm) of continuous ventilation. Many existing systems provide twice that amount of air exchange, so the interior air in winter gets very dry. In a dry, cold climate such as we experience here in Canada, more ventilation is not better ventilation, as winter relative humidity levels will fall well below the Health Canada guideline of 30% relative humidity. Dry air adversely affects the mucous membranes in our breathing system. Larger houses may need more ventilation air.

4. Do not, under any circumstances, cause fuel burning appliances to backdraft. A backdrafting furnace, water heater, or fireplace is a health hazard. Full stop. The only way to avoid backdrafting is to do away with naturally ventilated combustion equipment. This approach has been successfully implemented in the R-2000 program. If there are no appliances that can backdraft, negative pressures are not a problem. We have a long history of tall apartment buildings in this country that regularly have negative pressures of 20 pascals or more on the lower floors due to stack effect in winter time.

I also feel that every house with a combustion device of any kind should have a carbon monoxide detector.

5. Draw the exhaust air continuously from the odour and moisture producing areas. Bathrooms and kitchens should be the area from which the exhaust air is drawn.

6. Do not rely on the ventilation system to remove odours or smoke caused by burnt toast, or other unusual events. Virtually every house has operable windows, and these can be used to vent the kitchen in an unusual event. Domestic kitchens are not commercial kitchens, and we should not confuse the two. Designing ventilation systems that try to handle short-lived events greatly complicates the design, and is unnecessary. A recirculating range hood (regularly maintained) along with a modest exhaust grille may be adequate for most domestic kitchens that use electric ranges.

7. Make the system quiet and reliable. Fans should be chosen for long life, low noise and preferably should have self cleaning blades. I have noticed that axial flow fans are much less likely to clog than forward curved fans. Forward curved centrifugal fans tend to accumulate dust and dirt in their cup-shaped blades. Many axial flow fans used for computer cooling are rated for 100,000 hours continuous duty, or more than 11 years. However, axial fans generally are not as efficient when a resistance in the form of ducts and grilles is added.

A lot of residential exhaust equipment such as standard bathroom or kitchen fans reminds me of junky, automotive quality stuff. Most automobiles have an operating life of about 4,000 hours (less than half a year of continuous operation) [200,000 km at 50 km/hr] after which many moving parts (alternators, power steering pumps, water pumps, fan bearings, etc.) need replacement. Residential ventilation equipment should have a life of at least 10 years without maintenance.

8. Remember that the best is the enemy of the good. It is easy to add complications to ventilation systems–stuff like humidity controls, variable speed fans, multi-speed fans, complicated filters and scrubbers, ionizers, charcoal filters. The problem with these additions is that they complicate the system, and require regular maintenance most homeowners don't do. I think that they add few, if any, real benefits. Keep it simple and it will be good.

Please send any energy-related questions to robdumont@hotmail.com

Letter to the Editor

Re: Energy Answers, Solplan Review No. 93

First, I would like to compliment you on your continuing efforts to encourage sound, energy efficient construction practice through Solplan Review. I especially enjoyed your recent editorial comparison between economists and soothsayers!

I have often benefited from pointers from Rob Dumont. However, I have to take exception to his comments on "stranded" batt insulation. He states that "...pressing the insulation against either the outer or inner wall can restore the insulation value...". I would suggest that the batts must be pressed against the inner (warm) side of the cavity. If the vapour barrier is the most airtight component in the wall system, cold outside air will have access to any cavity between the vapour barrier and the insulation, and the room will be cooled by conduction through the drywall and convection through the insulation and sheathing. I suppose this would not be the case if an exterior air barrier is tighter than the vapour barrier, but this is not common practice in my neck of the woods.

Ken Anderson
Evergreen Construction,
Haines Junction, Yukon

Rob Dumont replies:

It is true that I did not take into account air leakage through the wall. It is also true that it is better to have the insulation on the warm side of the cavity if significant amounts of air can leak into the wall cavity. However, without significant air leakage, my comment that "pressing the insulation against either the outer wall or the inner wall can restore the insulation value" holds.

I recall reading a study done in the 1950s in which 2 x 4 walls were insulated with R-7 batts (roughly 2 inches thick). The walls were tested under controlled laboratory conditions for R value with the insulation in two locations in the cavity: against the outer sheathing, and against the inner gypsum board. The overall measured R values for the wall were the same (within experimental error) for the two insulation locations. All porous (fibre) insulation needs to be set against a solid material and also needs to be flush to a solid surface at the perimeter of the insulation to prevent convection currents.

An interesting result from the 1950s study was that if the R-7 batts were placed against the outer sheathing, a more uniform temperature would result on the room face of the wall. The reason for this was that the studs in the wall were exposed to more of the warm air in the cavity, and the room-side wall surface temperature at the studs was higher. "Ghosting" marks on the wall are thus less likely to appear if the batts are pressed against the outer sheathing in the cavity. Houses with smokers or with other significant sources of particulates (such as candles) are more prone to "ghosting" on the outer walls if the insulation is pressed against the inner wall part of the cavity.

Much insulation is installed in this country, so the insulation value is often compromised by poor installation and, as noted, by air leakage.

NRC·CNRC

IRC investigates new method for evaluating floor toppings

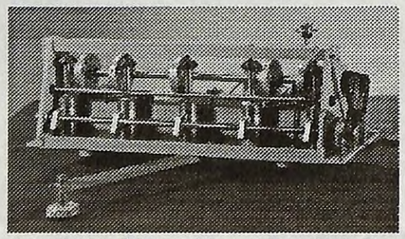
by Alf Warnock

In the last issue of Solplan Review (No. 93, July 2000) Alf Warnock reported some results of IRC research on the control of impact noise through floors in residential buildings. This issue we report on new developments in testing procedures for impact noise.

As a result of the efforts of IRC's Acoustics group, it looks as if there will be a new standard test method for evaluating the ability of floor coverings or toppings to reduce the transmission of impact sound from one floor to another in multi-family dwellings. At the moment, the only way to test a floor covering is as part of a complete floor assembly. Without additional testing, it is not possible to separate the properties of the covering from the properties of the rest of the floor assembly on which it rests.

Presented with test results for one floor covering tested on a 150-mm concrete slab and another product that may have been tested in a different laboratory on a joist floor with a plywood or oriented strand board subfloor, users find it impossible to make informed choices of coverings. The situation has become more urgent with the increased popularity of hardwood, wood laminate and ceramic floor finishes. When hard floor surfaces are used, additional materials or measures are often required to control impact sound.

Some new products combine a hard surface layer with a resilient (flexible) supporting layer that is intended to reduce impact sound transmission. These underlayments include shredded or foam rubber, plastic foams, cork and fibrous materials. Testing the many possible combinations of floor topping and resilient material as part of full-size, complete floors would be very expensive, but the proposed new test method changes this situation.



A tapping machine used in tests to evaluate the ability of floor coverings to reduce the transmission of impact sound from one floor to another in multi-family dwellings

A small, industry-supported project at IRC looked at ways of adapting an ISO test method developed primarily for concrete slab floors and making it suitable for the broader range of floors typically used in North America. The ISO method focuses on measuring the reduction in impact sound that can be directly attributed to the floor covering. Sound levels from a standard tapping machine are measured twice — once on a bare concrete slab and once with the covering in place on the slab. The difference between the two measurements is used to rate the impact sound attenuation of the covering.

One benefit of this approach is that variations among the results for the bare slabs found in different laboratories are negligible — the same improvement in the attenuation of impact sound is obtained whether the slab is 100 mm or 200 mm thick.

Furthermore, small specimens that do not completely cover the slab still give reliable measures of the impact noise reduction. This finding will reduce testing costs considerably for manufacturers developing new products.

The measured data showed that many floor toppings significantly improve the attenuation of impact sound when they are placed on a concrete slab. The topping cushions the hammer blows and turns the sharp "clacking" sounds into thuds. However, many of these same toppings have little effect when placed on a joist floor with a plywood or OSB subfloor. The surface of the subfloor, which is much softer than the surface of the concrete slab, often provides enough cushioning so that there is little added benefit from the topping — the rating for the floor is determined by the rest of the floor assembly.

The draft of a new test method is proceeding through the ASTM balloting process — most agree that such a test method is sorely needed. For the moment, the test method is limited to testing toppings on concrete slabs. However, more work is planned to develop a standard wood-joist floor that can be used to measure improvements in impact sound attenuation for this type of floor.

The partners in this project were:
Dura Undercushions
Kinetics Noise Control
Mason Industries
Vibro-Acoustics
The Noble Company

Specific questions can be directed to Dr. Alf Warnock at (613) 993-9370, fax (613) 954-1495, or e-mail alf.warnock@nrc.ca.

Coming Events

November 6-8, 2000
Durability and Disaster Mitigation in Wood Frame Housing
Madison, WI
Tel: 608-231-1361 ext 201
Fax: 608-231-2152

November 26-29, 2000
Canadian Association of Home Inspectors Annual Conference
Calgary, AB
Tel: 403-660-1348
Fax: 403-204-0898

December 5-9, 2000
Home Performance Strategies (training events)
San Ramon, Ca
Tel: 7241-223-7750
Fax: 724-223-7754
www. Affordablecomfort.org

January 17-18, 2001
Ontario Builders Forum
Toronto, Ontario.
Tel: 416-447-0077
Fax: 416-443-9982

February 18-21, 2001
CHBA National Conference
Edmonton, AB
Tel: 905-954-0730
Fax: 905-954-0732

March 1-4, 2001
World Sustainable Energy Day Conference and Trade Show
Wels, Austria
Tel: +43 732 6584 4380
Fax: +43 732 6584 4383
www.esv.or.at

April 30 - May 5, 2001
Affordable Comfort 2001
(Home performance industry's largest conference)
Milwaukee, WI
Tel: 7241-223-7750
Fax: 724-223-7754
www. affordablecomfort.org

Renewable Energy Education
Variety of courses on photovoltaic system design and installation, micro hydro, wind power, passive and active solar. Most courses in Carbondale Colorado, from May to October. For detailed schedule and course outline: Solar Energy International.
Tel: 970-963-8855
Fax 970-963-8866
www.solarenergy.org